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To cite this version:
Cécilia Gauvin, Delphine Jullien, Joseph Gril. Hygromechanical behaviour of a wooden panel. Wood and Science Technology conference, Oct 2014, Maastricht, Netherlands. 2014. hal-01769737

HAL Id: hal-01769737
https://hal.archives-ouvertes.fr/hal-01769737
Submitted on 18 Apr 2018

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Hygromechanical behaviour of a wooden panel

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Introduction

Wooden panel paintings from cultural heritage are excellent cases of study for an engineer. They are witness of ancient times and practices, and may provide keys to the understanding of long term behaviour of wooden structures [1,2]. A particularity of these objects is the permanent cupping of the panel. It seems to appear whatever the orientation of the panel cutting (quatersawn or flatsawn) and the position of the paint layer.

Material and Method

Panel mock-up

Fig. 1: Digital image correlation technics - Track marking with continuous weighting

Fig. 2: Relative Humidity (RH) set over the time

Mechanical simulation : wetting

(a): 0h
(b): 6h
(c): 20h
(d): 49h
(e): 223h
(f): 321h

Fig. 3: Mean Moisture Content (MC) over the time (%)

Vertical strain (E22) and shear (E12) are negligible compared to the horizontal strain (E11)

Fig. 4: Horizontal strain (E11) of the surface of the panel with four coated lateral faces, over the time, corresponding to Fig. 3 points

Mass transfer simulation: drying

Fig. 5: Moisture content distribution into the cross section of a panel with four coated lateral faces, obtained by mass transfer simulation using the software Transpore [3], corresponding to Fig. 3 points

Wood and Science Technology, Maastricht, 17-18 October 2014

References:

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